

***NASA Exploratory Technologies for the NAS
Communications/Navigation/Surveillance Technologies
Research and Development***

***Session 4-Oceanic/Remote
Communications and Surveillance
Session 3- Space-Based Surveillance***

***Gus Martzaklis – Chairman
Ricardo Parra – Co-Chairman***

***NExTNAS-CNS Breakout Session Results
21 August 2003***

Assumptions & Observations

- ATOP as planned will meet 30/30 separation requirement by 2008
- Current systems are very expensive (both messaging & avionics); need technologies for cost reduction
- ATN currently not part of oceanic architecture
 - While approved by ICAO, no investment for oceanic airspace
- WG unclear on SB-Radar & Multilat role/need for ATM
 - Agree there is variance in resolution and non-uniformity of surveillance globally (US, oceanic, remote), however not sure if this equates to ATM/capacity constraints
 - Ground-based solutions (radar, ADS-B.. address high density need)
 - Aviation Security (i.e. GA) and Safety (e.g. Africa) seem to have stronger reqt's for these, not capacity/ATM
- WG recommends NASA/NRO/Other host TIM on capabilities of space-based surveillance as it relates to potential aviation applications

Recommendations

- Investigate the limits of current architecture/technology for separation reduction
 - Latency, Update rates, Coverage, Cost
- Satellite-based ADS should be investigated for
 - Oceanic & Remote airspace in meeting 15/15 (oceanic) and 5nm (off-shore) separation goals
 - As potential alternative to ground-based ADS in domestic airspace
 - Cost reduction (messaging & avionics) as compared to current offerings

Long Term:

- Govn't operated SATCOM (w/FIS/Wx)
- Satellite/ADS-B hybrid schemes

Short Term:

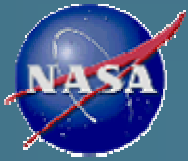
- Investigate alternative SATCOMs (Iridium, Globalstar..)
- Lower cost avionics for alternatives
- *Leverage GCNSS/Boeing evaluation data from GoM SATCOM trials*

Recommendations (2)

- Non-SATCOM alternatives (HAA, HF, A/C repeaters..) should be in trade space
- Relevant activities should be leveraged
 - GCNSS/Boeing GoM Satcom work
 - ATOP
- Should evaluate SB-Radar activities by NRO/DoD & DHS/NASA Aviation Security for ATC application
 - *Leverage flight opportunities with DoD/Pacific & NASA AvSec*
- Investigate how to integrate oceanic/remote with ATN
- Due to uncertainty of SB-Radar/multilat for ATM, recommend:
 - FY04 task to look at feasibility of these for ATM (to be done by or with Architecture sub-project?)
 - Decision gate prior to FY05 on whether to pursue proposed plan
 - *Incorporate Boeing ATM investigation/work in this area*

Recommendations (3)

- NExTNAS should investigate improved satellite weather sensing technologies for ATM
 - Leverage FAA AWRP and NASA aviation weather research programs
 - Note: Regulatory issues associated with the use of weather information for navigation should be addressed



4 – Oceanic/Remote Communications and Surveillance



Problem Statement:

Oceanic and remote regions have no direct communications or surveillance capabilities, requiring aircraft spacings up to 60 nm for safe operations, resulting in major operational inefficiencies.

Objective:

Develop and demonstrate affordable component and system technologies enabling cooperative surveillance, direct pilot-controller communication, and pertinent weather information to enable safe oceanic spacing reductions to 30/30 nm with potential future reduction to 15/15 nm.

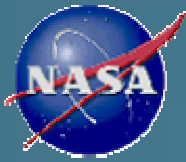
Product Description:

Develop and demonstrate an affordable prototype satellite-based system to provide communications and surveillance capabilities to enable safe aircraft spacing reduction in oceanic and remote airspace.

- Study requirements and assess candidate solutions
- R & D to mitigate technology gaps
- Develop and validate system concept
- Enable system integration with oceanic ATC
- Demonstrate and evaluate oceanic solution through flight tests

Resources/Schedule:

Tasks	FY 04	FY 05	FY 06	FY 07	FY 08
System Study	System Tech Def'n				
Component R&D		Oceanic Satcom Technology Development			
System Demos			Oceanic C & S Pilot Tests and System Demo		



Oceanic/Remote Communications and Surveillance



Problem Statement:

Lack of accurate, precise, and affordable position services in the oceanic airspace limit ability to reduce separation.

- What is the role for ADS-B via satellite in domestic airspace?
- Is there a cost effective role for use of DOD and other technology for ATC?

Objective:

Develop and demonstrate affordable component and system technologies enabling dependent surveillance, direct pilot-controller communication, and pertinent flight information to enable **safe separation and oceanic reductions to 15/15 nm and 5nm off-shore** with a cost reduction of 30%.

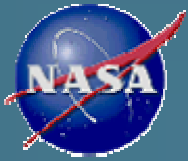
Product Description:

Develop and demonstrate an affordable prototype system to provide communications and surveillance capabilities to enable safe aircraft spacing reduction in oceanic and remote airspace.

- Study requirements and assess candidate solutions
- R & D to mitigate technology gaps
- Develop and validate system concept
- Enable system integration with oceanic ATC
- Demonstrate and evaluate oceanic solution through flight tests

Schedule:

Tasks	FY 04	FY 05	FY 06	FY 07	FY 08
System Study	System Tech Def'n				
Component R&D		Oceanic Satcom Technology Development			
System Demos			Oceanic C & S Pilot Tests and System Demo		



Oceanic/Remote Communications and Surveillance



Sub-Project Approach:

FY 04

- Requirements and operational cost/benefit analyses
- Identify and assess candidate technologies and identify technology gaps
- Develop required industry-government partnerships

FY 05

- Initiate research and development to mitigate technology gaps
- Establish satellite oceanic C & S concept pilot test
- Initiate planning for oceanic ATC integration

FY 06

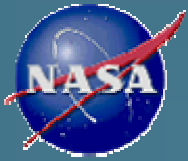
- Continue satellite oceanic C & S pilot test and evaluation of test data
- Evaluate developed components and initiate installation of components and systems for flight tests
- Finalize oceanic C & S system concept; complete system prototype development

FY 07

- Complete installation of prototype components and systems for flight tests
- Execute flight demonstrations and evaluations

FY 08

- Complete flight test campaign and evaluate results
- Complete technology transfer activities
- Complete oceanic ATC integration



Space-Based Surveillance



Problem Statement:

Accurate and precise aircraft position is not uniformly available in all places through present cooperative and non-cooperative surveillance capabilities. Constraints in system capacity result due to an inability to reduce aircraft separation minima.

Product Description:

Assessment of space-based surveillance technologies and methodologies to determine their role in the future NAS

- Space-based radar
- Space-based multilateration
- Satellite-based ADS/TIS

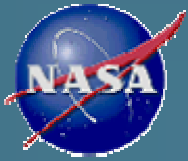
Objective:

Identify space-based technologies that can provide high resolution surveillance information in all airspace with uniform coverage.

Investigate benefits and cost of technology enhancements for space-based radar, multilateration, and satellite-based ADS/TIS to improve system performance.

Schedule:

Tasks	FY 04	FY 05	FY 06	FY 07	FY 08
Reqmts. Study		◆	◆		
Technology Assessment			◆	◆	◆
Proof of Concept Demos			◆	◆	◆



3 – Space-Based Surveillance



Problem Statement:

Current communication and surveillance technologies (e.g. FANS 1A) limit the potential for separation reduction and will result in major operational inefficiencies as traffic grows in the future.

Product Description:

Assessment of space-based surveillance technologies and methodologies to determine their role in the future NAS

- Space-based radar
- Space-based multilateration
- Satellite-based ADS/TIS

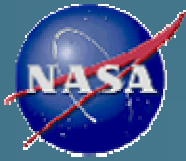
Objective:

Identify space-based technologies that can provide high resolution surveillance information in all airspace with uniform coverage.

Investigate benefits and cost of technology enhancements for space-based radar, multilateration, and satellite-based ADS/TIS to improve system performance.

Schedule:

Tasks	FY 04	FY 05	FY 06	FY 07	FY 08
Reqmts. Study		◆	◆		
Technology Assessment			◆	◆	◆
Proof of Concept Demos			◆	◆	◆



Space-Based Surveillance



Sub-Project Approach:

FY 05

- Perform study of requirements for space-based surveillance technologies incorporating benefits and cost of space-based radar, space-based multilateration, and space-based ADS/TIS

FY 06

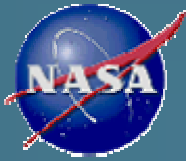
- Initiate technology assessment and analyze improvements and implications of space-based technologies on existing cooperative and non-cooperative systems
- Perform simulations to verify analysis for improving resolution of surveillance coverage to enhance capacity

FY 07

- Initiate design and development of proof-of-concept system technology

FY 08

- Complete system performance test, characterization and demonstration of select space-based surveillance methods and technologies



Space-Based Surveillance



Sub-Project Approach:

FY 04

- Perform a feasibility study of space based surveillance

FY 05

- Perform study of requirements for space-based surveillance technologies incorporating benefits and cost of space-based radar, space-based multilateration, and space-based ADS/TIS

FY 06

- Initiate technology assessment and analyze improvements and implications of space-based technologies on existing cooperative and non-cooperative systems
- Perform simulations to verify analysis for improving resolution of surveillance coverage to enhance capacity

FY 07

- Initiate design and development of proof-of-concept system technology

FY 08

- Complete system performance test, characterization and demonstration of select space-based surveillance methods and technologies